

U.S. Patent Application Serial No. **09/669,448**  
Amendment dated November 12, 2003  
Reply to OA of **May 23, 2003**

**AMENDMENTS TO THE CLAIMS:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

**Claim 1 (Currently Amended):** A semiconductor laser device comprising:

a substrate;

a first conductivity type cladding layer;

an emission layer;

a second conductivity type carrier blocking layer;

a second conductivity type cladding layer containing Al as a group III element and formed with a ridge portion;

a current blocking layer, formed on said second conductivity type cladding layer around said ridge portion, containing Al as a group III element in this order, wherein

an angle  $\theta$  of inclination on a side surface of said ridge portion with respect to an upper surface of said substrate is at least  $70^\circ$  and not more than  $117^\circ$ ,

a distance  $t$  between said emission layer and said current blocking layer satisfies a relation of  $t \leq 0.275/(1 - (X_2 - X_1))$  micrometer assuming that  $X_1$  represents a composition ratio of Al in group III elements forming said second conductivity type cladding layer,  $X_2$  represents a composition ratio of Al in group III elements forming said current blocking layer, wherein said

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distance t includes the thickness of said second conductivity type cladding layer and the thickness of said carrier blocking layer, and

a lower width W of said ridge portion is at least 2  $\mu\text{m}$  and not more than 5  $\mu\text{m}$ .

**Claim 2 (Currently Amended):** A semiconductor laser device according to claim 1, wherein

said first conductivity type cladding layer contains Al and Ga as group III elements, and X1 represents a composition ratio of Al in a sum of a contents composition of Al and Ga, and

said current blocking layer contains Al and Ga, and as group III elements, and X2 represents the composition ratio of Al in the sum of a contents composition of Al and Ga.

**Claim 3 (Original):** The semiconductor laser device according to claim 2, wherein

said second conductivity type cladding layer is made of  $\text{Al}_{x_1}\text{Ga}_{1-x_1}\text{As}$ , and

said current blocking layer is made of  $\text{Al}_{x_2}\text{Ga}_{1-x_2}\text{As}$ .

**Claim 4 (Previously Presented):** The semiconductor laser device according to claim 1, wherein

said distance t between said emission layer and said current blocking layer satisfies a relation of  $t \leq 0.252/(1 - (X_2 - X_1))$  micrometer.

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**Claim 5 (Previously Presented):** The semiconductor laser device according to claim 1,  
wherein

said distance t between said emission layer and said current blocking layer is at least 0.15  $\mu\text{m}$ .

**Claim 6 (Previously Presented):** The semiconductor laser device according to claim 1,  
wherein

said distance t between said emission layer and said current blocking layer is at least 0.2  $\mu\text{m}$ .

**Claim 7 (Previously Presented):** The semiconductor laser device according to claim 1,  
wherein

an upper surface of said substrate is a {100} plane or inclined by several degrees, and said ridge portion extends in a <011> direction.

**Claim 8 (Canceled)**

**Claim 9 (Withdrawn):** A method of manufacturing a semiconductor laser device comprising  
steps of:

forming a first conductivity type cladding layer, an emission layer, a second conductivity type  
first cladding layer having a prescribed thickness, an etching stop layer and a second conductivity

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type second layer cladding layer having a composition ratio X1 of Al in group III elements on a substrate in this order;

partially removing said second cladding layer thereby forming a ridge portion having an angle  $\theta$  of inclination of at least  $70^\circ$  and not more than  $117^\circ$  on the side surfaces with respective to the upper surface of said substrate and a lower width W of at least  $2 \mu\text{m}$  and not more than  $5 \mu\text{m}$ ; and

forming a current blocking layer on both sides of said ridge portion so that the distance t between the upper surface of said second conductivity type second cladding layer exposed around said ridge portion and said emission layer satisfies the relation of  $t \leq 0.275/(1 - (X_2 - X_1)) [\mu\text{m}]$  assuming that X2 represents the composition ratio of Al in group III elements and t represents said distance.

**Claim 10 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 9, wherein

said first conductivity type cladding layer contains Al and Ga as group II elements, and X1 represents the composition ratio of Al in the sum of the contents of Al and Ga, and

said current blocking layer contains Al and Ga as group III elements, and X2 represents the composition ratio of Al in the sum of the contents of Al and Ga.

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**Claim 11 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 10, wherein

    said second conductivity type first and second cladding layers are made of  $\text{Al}_{x_1}\text{Ga}_{1-x_1}\text{As}$ , and  
    said current blocking layer is made of  $\text{Al}_{x_2}\text{Ga}_{1-x_2}\text{As}$ .

**Claim 12 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 9, wherein

    said distance  $t$  satisfies the relation of  $t \leq 0.252/(1 - (X_2 - X_1))$  [ $\mu\text{m}$ ].

**Claim 13 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 9, wherein

    said distance  $t$  is at least 0.15  $\mu\text{m}$ .

**Claim 14 (Withdrawn):** The semiconductor laser device according to claim 1, wherein  
    said distance  $t$  is at least 0.2  $\mu\text{m}$ .

**Claim 15 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 9, wherein

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the upper surface of said substrate is the {100} plane or inclined by several degrees from the {100} plane, and

said step of forming said ridge portion includes steps of forming a mask extending in the <011> direction and performing etching with said mask.

**Claim 16 (Withdrawn):** The method of manufacturing a semiconductor laser device according to claim 9, wherein

the upper surface of said substrate is the  $\bar{1}00\}$  plane or inclined by several degrees from the  $\bar{1}00\}$  plane, and

said step of forming said ridge portion includes steps of forming a mask extending in the < $\bar{0}11\>$  direction and performing etching with said mask.